82826
S/048/60/024/008/002/017
B012/B067

Methods of Calculating the Cross Sections of Atom Excitation by Electrons

of partial spherical waves into plane waves. There are 7 references: 3 Soviet and 4 British.

ASSOCIATION: Fizicheskiy institut im. P. N. Lebedeva Akademii nauk SSSR (Institute of Physics im. P. N. Lebedev of the Academy of Sciences, USSR)

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20660

S/057/61/031/001/005/017
B104/B204

9.1912 (also 2603)
9.3100 (1103,1127,1160)

AUTHOR: Vaynshteyn, L. A.

TITLE: Current waves in a thin cylindrical conductor. III. The variational method and its application to the theory of perfect and impedance wires

PERIODICAL: Zhurnal tekhnicheskoy fiziki, v. 31, no. 1, 1961, 29-44

TEXT: A number of boundary problems in mathematical physics, but especially in electrodynamics, leads to integral equations of integro-differential equations of the form $GJ + K = 0$ (1), where K and J are known functions on a surface (edge of a body), and G is a linear integral operator or integro-differential operator. The variational principle for equations of type (1) is formulated in the first part of the paper. It is assumed that to the functions K_α and K_β, which are given on a surface S, the functions J_α and J_β correspond, and that these functions satisfy the equations $GJ_\alpha + K_\alpha = 0$ and $GJ_\beta + K_\beta = 0$ (2). For any pair of functions

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Current waves in a thin ...

K_i and J_1, a product $\langle K_i, J_1 \rangle$ is defined, so that e.g. $\langle K_\alpha, J_\beta \rangle = \langle J_\beta, K_\alpha \rangle$, and the demand is made that the equation $\langle J_\alpha, GJ_\beta \rangle = \langle J_\beta, GJ_\alpha \rangle$ be satisfied for any functions J_α and J_β on the surface S. The functional $z_{\alpha\beta} = \frac{\langle J_\alpha, GJ_\beta \rangle}{\langle K_\alpha, J_\beta \rangle \langle K_\beta, J_\alpha \rangle}$ (4) is then steady, i.e., when varying J_α and J_β, $\delta z_{\alpha\beta} = 0$ (5). In electrodynamics, the product $\langle K_\alpha, J_\beta \rangle$ is appropriately defined by $\langle K_\alpha, J_\beta \rangle = \int_S (K_\alpha, J_\beta) dS$ (6), where (K_α, J_β) is the inner product of the field strength K_α of the external field and of the surface current density J_β. For a cylindrical, perfectly conducting wire, the boundary condition $E_z + E_z^e = 0$ (10) is a special case of (1), for which the operator G is determined. The same applies to the boundary condition $E_z + E_z^e = ZJ$ (19) for a wire with finite resistance, where Z is the

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S/057/61/031/001/005/017
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internal impedance of the wire. In a previous paper, the author showed that in a thin, perfectly conducting wire, all waves arising from the reflection of a wave produced by an external emf, may be approximately described by the function $\psi(z)$.

$$\psi(z) = \ln \frac{-1}{\gamma^2 q} \Psi(x,q) \qquad (22)$$

The symbols in this function were taken from previous papers by the author and are not defined. $\psi(z)$ and $\Psi(x,q)$ are obtained in successive approximation, using the above-described variational method. A unilaterally bounded wire is considered to be a passive vibrator, which is excited by an external field. With reference to the above papers by the same author, expressions are obtained for K_β and K_α, as well as for J_α and J_β. V. V. Vladimirskiy (Ref. 5) studied the excitation of an infinite impedance wire, and without great difficulties he obtained a formal solution. For investigating the current in this wire, this solution can hardly be applied, and the author gives some approximations of functions, which play a part in the theory of the impedance wire of finite length. These approximations are obtained by the variational method described here. The approximation

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Current waves in a thin ...

method suggested here may be used for many problems, especially for such in which slowly varying functions play an important part. There are 5 figures, 1 table, and 5 references: 3 Soviet-bloc and 1 non-Soviet-bloc.

ASSOCIATION: Institut fizicheskikh problem AN SSSR Moskva (Institute of Physical Problems of the AS USSR, Moscow)

SUBMITTED: May 3, 1960

Card 4/4

20661

9,1912
9.1000 (also 2603,1103,1127)
9.1300 (also 1130)

S/057/61/031/001/006/017
B104/B204

AUTHOR: Vaynshteyn, L. A.

TITLE: Current waves in a thin cylindrical conductor. IV. Input impedance of a vibrator, and the accuracy of formulas

PERIODICAL: Zhurnal tekhnicheskoy fiziki, v. 31, no. 1, 1961, 45-50

TEXT: In an earlier paper (Ref. 1), the author showed that the current produced in a thin, straight-lined conductor (reflecting vibrator) by an electromotive force applied at point z = 0, may be described in the form

$$J(z) = \frac{c\mathcal{E}}{4\ln(i/\gamma ka)}\left\{\psi(|z|)e^{ik|z|} - B_1\psi(z - z_1)e^{ikz} - B_2\psi(z_2 - z)e^{-ikz}\right\} \quad (1)$$

if $z_1 < z < z_2$. B_1 and B_2 are determined from the condition $J(z_1) = J(z_2) = 0$ (3) at the ends, and $\psi(z)$ is a slowly varying function, which takes the effect of emission upon the propagation of current waves into account. $\psi(z)$ and $\psi_+(z)$ and $\psi_-(z)$ by which it is generated, determine

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the emission characteristic of the reflecting vibrator, the current which is excited by a plane wave in a passive vibrator. Eq. (1) and similar expressions obtained by means of slowly varying functions are approximations, whose accuracy is determined by the functions kz and $\bar{\Omega} = 2\ln(i/\gamma ka)$ $(\gamma = 1.781\ldots)$ (4). The greater these parameters, the greater will be the accuracy of (1). As an example, the excitation of a finite wire is studied, in which the current is described at $ka \ll 1$ with the help of the integral

$$J(z) = \frac{i\omega\mathcal{E}}{4\pi}\int_{-\infty}^{\infty}\frac{e^{iwz}dw}{v^2\ln(2i/\gamma va)} \quad (16).$$

For this case, Eq. (1) assumes the form $J(z) = \frac{c\mathcal{E}}{2\bar{\Omega}}\psi(|z|)e^{ik|z|}$ (5) which offers good results. Thus, $J(o) = \frac{c\mathcal{E}}{2\bar{\Omega}}\theta_o = \frac{c\mathcal{E}}{2\bar{\Omega}}\left(1 + \frac{\pi^2}{3\Omega^2} + \ldots\right)$ (7), wherefrom the relation $1/Z = \frac{c}{2\Omega}\left\{\theta_o - B_1\psi(-z_1) - B_2\psi(z_2)\right\}$ (9) is obtained

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for the input impedance $Z = \mathcal{E}/J(0)$ (8). With $ka < 1$, the expressions for $J(z)$ practically agree for a solid and a hollow cylinder (waveguide). The great advantage of integral (16) is the fact that its convergence is quicker than that of other more exact solutions. A more exact solution for a current in a solid cylinder is given by

$$J(z) = \frac{i\omega a\mathcal{E}}{4\pi}\int_{-\infty}^{\infty}\Phi(w)\frac{H_1^{(1)}(va)e^{iwz}dw}{vH_0^{(1)}(va)} \quad (23),$$

which also permits an exact determination of the input impedance. However, the function $\Phi(w)$ is, in general, unknown. The final part of this paper deals with the calculation of the integral

$$\Phi_0 = \int_0^{\infty}\frac{dt}{\tau\left\{\left(\ln\frac{\Gamma^2\tau}{2i}\right)^2 + \pi^2\right\}} \quad (24),$$

where $\tau = t(1 - t/2iq)$, $q = (ka)^2$.

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Current waves in a thin ...

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B104/B204

θ_o is calculated from the asymptotic formula $\theta_o = 1 + \pi^2/3\bar{\Omega}^2$ (30) by E. Hallén. The following relation exists between θ_o and $\bar{\Omega}$: $\theta_o = \bar{\Omega}\,\Phi_o$ (25). The relation $\Phi_o = \Phi_1 - i\,\Phi_2$ is given for (24), and values for Φ_1 and Φ_2 are given in Table 1. These values were calculated on the computer "Ural" by A. M. Gal'. There are 1 table and 5 references: 4 Soviet-bloc and 1 non-Soviet-bloc.

ASSOCIATION: Institut fizicheskikh problem AN SSSR Moskva (Institute of Physical Problems of the AS USSR, Moscow)

SUBMITTED: May 3, 1960

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S/056/60/039/003/029/045
B006/B063

AUTHORS: Vaynshteyn, L. A., Sobel'man, I. I.

TITLE: Deduction of the Radial Equations of the Theory of Collisions Between Electrons and Atoms

PERIODICAL: Zhurnal eksperimental'noy i teoreticheskoy fiziki, 1960, Vol. 39, No. 3(9), pp. 767-775

TEXT: The various perturbation-theoretical methods used for calculating the cross sections of atomic excitation by slow electrons are usually insufficient. A more general treatment of the problem requires solving the system of integro-differential equations for the radial wave functions of the external electron, which are analogous to the Hartree-Fok equations in the multiconfigurational approximation of the atomic theory. In the present paper, the authors give a deduction of equations describing the excitation of an arbitrary level of a many-electron atom; so far, such equations have been obtained for some special cases only (e.g., Ref. 1). The radial equations derived here take account of the non-orthogonality of the wave functions of the external and optical electrons; magnetic interaction is neglected. The well-known non-uniqueness which appears
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S/056/60/039/003/029/045
B006/B063

Deduction of the Radial Equations of the Theory of Collisions Between Electrons and Atoms

when approximate atomic wave functions are used, is discussed. An approximate form of the equations is proposed, which is based on the neglect of terms which contain both non-orthogonality integrals and higher multipole interactions. In this approximation, the non-uniqueness disappears if semi-empirical wave functions are employed for the optical electron. There are 5 references: 1 Soviet, 2 US, and 2 British.

ASSOCIATION: Fizicheskiy institut im. P. N. Lebedeva Akademii nauk SSSR (Institute of Physics imeni P. N. Lebedev of the Academy of Sciences USSR)

SUBMITTED: April 13, 1960

Card 2/2

21428
S/109/61/006/001/005/023
E032/E114

9,3700 (1163,1127,1036)
9,9800

AUTHORS: Vaynshteyn, L.A., and Fedorov, A.A.

TITLE: Scattering of plane and cylindrical waves by an elliptical cylinder and the concept of diffraction rays

PERIODICAL: Radiotekhnika i elektronika, Vol.6, No.1, 1961, pp. 31-46

TEXT: The present state of the theory of diffraction of electromagnetic waves by convex conducting bodies is largely based on the papers of V.A. Fok (Refs.1-7). These papers introduced special functions (attenuation coefficients) which determine the diffraction field for different dispositions of the source and the point of observation. To start with, these functions refer to the "half-shadow" region. In the illuminated region they go over into the formulae of geometrical optics and have been extended to all points for the case of a sphere (Belkina and Vaynshteyn, Ref.9, and Fedorov, Ref.10) and a circular cylinder (Goryainov, Ref.11). However, it is stated that the generalisation of the various formulae to a surface with a variable curvature is not obvious. This generalisation has been carried out by J.B. Keller (Ref.12)

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E032/E114

Scattering of plane and cylindrical waves by an elliptical cylinder and the concept of diffraction rays

In the case of two-dimensional problems. Keller introduced the concept of diffraction rays which have curvilinear sections lying on the surface of the body and represent waves which have experienced diffraction in the normal sense of the term. On this basis the total field can be represented as a sum of contributions due to ordinary rays obeying the laws of geometrical optics and the above diffraction rays. The present authors emphasise that the concept of diffraction rays is still not completely justified from the theoretical point of view. It is simply a device for obtaining a physical interpretation and a short formulation of the asymptotic laws of diffraction for a certain class of problems. In the present paper the authors derive the asymptotic solution for the diffraction by a convex cylinder with variable surface curvature and the cylinder is then used to give a theoretical foundation for the concept of diffraction rays. The cylinder is taken in the form of an elliptical cylinder and the discussion specialised to two-dimensional fields and simple boundary

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E032/E114

-ing of plane and cylindrical waves by an elliptical
cy- and the concept of diffraction rays

in the case of two-dimensional problems. Keller introduced the concept of diffraction rays which have curvilinear sections lying on the surface of the body and represent waves which have experienced diffraction in the normal sense of the term. On this basis the total field can be represented as a sum of contributions due to ordinary rays obeying the laws of geometrical optics and the above diffraction rays. The present authors emphasise that the concept of diffraction rays is still not completely justified from the theoretical point of view. It is simply a device for obtaining a physical interpretation and a short formulation of the asymptotic laws of diffraction for a certain class of problems. In the present paper the authors derive the asymptotic solution for the diffraction by a convex cylinder with variable surface curvature and the cylinder is then used to give a theoretical foundation for the concept of diffraction rays. The cylinder is taken in the form of an elliptical cylinder and the discussion is specialised to two-dimensional fields and simple boundary

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S/109/61/006/001/005/023

Scattering of plane and cylindrical.. E032/E114

conditions. In particular, the diffraction of cylindrical and plane waves by a perfectly reflecting elliptical cylinder is discussed, assuming that the transverse dimensions and radii of curvature of the cylinder are large in comparison with the wavelength. The exact solution of the problem is obtained in the form of a series and a contour integral. When the asymptotic expressions for the radial and angular functions of the elliptical cylinder are substituted into the solution, one obtains the special functions introduced by V.A. Fok. The asymptotic solution obtained in this way corresponds to the concept of diffraction rays of J.B. Keller (Ref.12).
There are 2 figures and 16 references: 14 Soviet and 2 non-Soviet.

SUBMITTED: May 3, 1960

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VAYNSHTEYN, L.A.

Symposium on the diffraction of waves. Radiotekh. i elektron. 6 no.4:676-678 Ap '61. (MIRA 14:3)
(Waves--Diffraction)

MALYUZHINETS, G.D.; VAYNSHTEYN, L.A.

Transverse diffusion during diffraction on an impedance cylinder with a large radius. Part 1: Parabolic equation in beam coordinates. Radiotekh. i elektron 6 no.8:1247-1258 Ag '61. (MIRA 14:7)

1. Akusticheskiy institut AN SSSR i Institut fizicheskikh problem AN SSSR.
(Radio waves--Diffraction) (Optics, Geometrical)

28524

9.3140 (also 1140,1141,8901)

S/109/61/006/009/007/018
D201/D302

AUTHORS: Vaynshteyn, L.A., and Malyuzhinets, G.D.

TITLE: Transverse diffusion during diffraction at a large radius waveguide post. Part II. Asymptotic diffraction laws in polar coordinates

PERIODICAL: Radiotekhnika i elektronika, v. 6, no. 9, 1961, 1489-1495

TEXT: In part I of their work the authors derived the general solution of a two dimensional diffraction problem of a waveguide rod having a radius much larger than the wavelength. In the present article the authors show that this solution may be also obtained from the exact solution of the wave equation by using the known asymptotic formulae for the Hankel function. Using the notation of their previous work the solution is said to evaluate the function (r, φ, r') in the multi-sheet plane. The green function, then in a physical plane is obtained by summation of function Γ along all sheets. The function is easily obtained as a series

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$$\Gamma(r, \varphi, r') = -\frac{4\pi i}{ka} \sum_{s=1}^{\infty} \frac{H_{\nu_s}^{(1)}(kr) H_{\nu_s}^{(1)}(kr') e^{i\nu_s|\varphi|}}{H_{\nu_s}^{(1)}(ka) \frac{\partial}{\partial \nu} \left[\frac{dH_\nu^{(1)}(ka)}{d(ka)} + igH_\nu^{(1)}(ka) \right]_{\nu=\nu_s}} \quad (1)$$

or as a contour integral

$$\Gamma(r, \varphi', r') = \frac{\pi i}{2} \int_C e^{i\nu|\varphi|} H_\nu^{(1)}(kr') \left[H_\nu^{(2)}(kr) - \frac{\frac{dH_\nu^{(2)}(ka)}{d(ka)} + igH_\nu^{(2)}(ka)}{\frac{dH_\nu^{(1)}(ka)}{d(ka)} + igH_\nu^{(1)}(ka)} H_\nu^{(1)}(kr) \right] d\nu, \quad (2)$$

where the contour C contains all points ν_s (s = 1, 2 ...) in the positive direction, which are the roots of

$$\frac{dH_\nu^{(1)}(ka)}{d(ka)} + igH_\nu^{(1)}(ka) = 0, \quad (3)$$

obtained from the boundary conditions

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$$\frac{\partial \Gamma}{\partial r} + ikg\Gamma = 0 \text{ when } r = a \tag{4}$$

for function Γ. Formulae (1) and (2) give the formal solution of the problem. The authors consider the case when $ka \gg 1$ when asymptotic laws of diffraction at convex plane come into effect. Thus considering the geometry of Fig. 1

$$H_\nu^{(1)}(kr) = \sqrt{\frac{2}{\pi kr\sin\theta}}\, e^{i\left(kr\sin\theta - \nu\theta - \frac{\pi}{4}\right)},$$

$$H_\nu^{(2)}(kr) = \sqrt{\frac{2}{\pi kr\sin\theta}}\, e^{-i\left(kr\sin\theta - \nu\theta - \frac{\pi}{4}\right)}, \tag{15}$$

is obtained, where

$$a = r\cos\theta. \tag{16}$$

If to the main part of contour C in integral (2) the Debye formulae

$$H_\nu^{(1)}(kr) = \sqrt{\frac{2}{\pi}}\,\frac{e^{i\left(\xi - \frac{\pi}{4}\right)}}{\sqrt[4]{(kr)^2 - \nu^2}}, \quad H_\nu^{(2)}(kr) = \sqrt{\frac{2}{\pi}}\,\frac{e^{-i\left(\xi - \frac{\pi}{4}\right)}}{\sqrt[4]{(kr)^2 - \nu^2}}, \tag{13}$$

can be applied, then the integral in (2) takes the form of

$$\Gamma = i \int_C \left[e^{i(\nu|\varphi| + \xi' - \xi)} + \frac{\sqrt{1 - \left(\frac{\nu}{ka}\right)^2} - g}{\sqrt{1 - \left(\frac{\nu}{ka}\right)^2} + g} e^{i(\nu|\varphi| + \xi' + \xi - 2\xi_a)} \right] \times \frac{d\nu}{\sqrt[4]{(kr')^2 - \nu^2}\,\sqrt[4]{(kr)^2 - \nu^2}}, \tag{17}$$

in which ξ' and ξ_a are obtained from ξ for r = r' and r = a respectively. This integral can be evaluated by the method of stationary phase which leads to the following expression for the reflected wave

$$\Gamma^1 = \sqrt{\frac{2\pi}{kS}}\, e^{i\left[k(s'+s) + \frac{\pi}{4}\right]} \frac{\cos\chi - g}{\cos\chi + g}, \tag{31}$$

where

$$S = s' + s + \frac{2s's}{a\cos\chi}. \tag{32}$$

which is in full agreement with geometrical optics. If the func-

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D201/D302

Transverse diffusion during ...

tion is replaced by the asymptotic expression obtained by mathematical treatment of the asymptotic representation of Hankel function, where w, $w_1(t)$ and $w_2(t)$ are Airy functions

$$w_1'(t) - qw_1(t) = 0, \quad q = iMg \tag{36}$$

is derived. With the condition

$$g = - i/g/, \quad q = M/g/ \gg 1 \tag{37}$$

Eq. (36) has a "particular" root equal in first approximation to

$$t = q^2 \tag{38}$$

and in the second approximation having an exponentially small imaginary part. This "particular" root does not exist when the radio-waves are propagated along the earth surface, i.e. when

$$\frac{\pi}{4} < \arg q < \frac{\pi}{2}; \tag{39}$$

under condition (37) this root exists, however, and corresponds to X

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D201/D302

Transverse diffusion during ...

a surface wave, propagating around the cylinder with small attenuation. The dependance of this wave on the azimuth φ is determined in the first approximation by the factor

$$e^{i\nu|\varphi|}, \quad (40)$$

where

$$\nu = ka\left(1 + \frac{1}{2}|g|^2\right).$$

---- It follows from (40) that formulae (36) and (37') may be applied only for $/g/ \ll 1$, when the phase velocity of the surface wave is near that to the velocity in free space and thus the "surface character" of the wave shows little. Finally the strict solution is given in beam coordinates. There are 3 figures and 7 references: 3 Soviet-bloc and 4 non-Soviet-bloc. The references to the English language publications read as follows: N.D. Kazarinoff, R.K. Ritt, IRE Trans, 1959, AP 7, December 21; B.R. Levy, J.B. Keller, Canadian J. Phys, 1960, 38, 1, 128; R.S. Elliott, J. Appl. Phys., 1955, 26, 4, 368; J.R. Wait, IRE Trans, 1960, AP-8, 4, 445.

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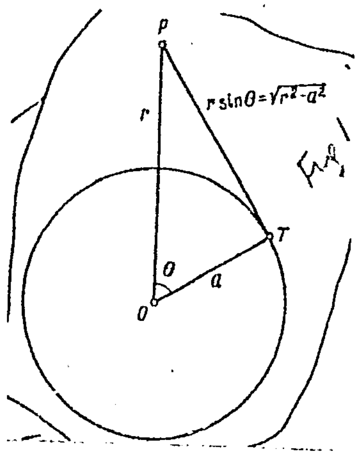
Transverse diffusion during ... S/109/61/006/009/007/018
D201/D302

ASSOCIATION: Institut fizicheskikh problem AN SSSR, akusticheskiy institut AN SSSR (Institute of Physical Problems AS USSR; Institute of Acoustics AS USSR)

SUBMITTED: January 1, 1961

Fig. 1.



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24.6200
11.1520
E1d(b) 3 cys/E3a(w) 2 cys

S/051/61/011/003/001/003
E032/E314

AUTHOR: Vaynshteyn, L.A.

TITLE: Excitation of Atoms and Ions by Electron Impact
I. Calculations Not Including Exchange Effects

PERIODICAL: Optika i spektroskopiya, 1961, Vol. 11, No. 3, pp. 301 - 307

TEXT: The present author reports calculations of excitation cross-sections for a large number of transitions in various atoms and ions using the Born and distorted-wave methods without allowance for exchange effects. This is said to be the first stage in a general programme; exchange effects and electron correlation will be taken into account in the second stage. Preliminary results for the $1^1S - n^1P$ transitions in helium atoms were reported by the present author and G.G. Dolgov in Ref. 1 (Optika i spektroskopiya, 1959, 7, 3). The general equations were reported by the present author and I.I.Sobel'man in Ref. 3 (ZhETF, 39, 767, 1960). The following atoms were

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Excitation of Atoms and Ions S/051/61/011/003/001/003
E032/E314

X

considered in the present work: H, He, Na, C^+, C^{2+}, C^{3+}, C^{4+} and C^{5+}. All the calculations were carried out using an electronic computer and a single programme. Table 1 gives the excitation cross-section for various transitions (in units of πa_0^2) for hydrogen. The columns marked "Б" refer to the Born approximation and the columns marked "И. В." to [illegible] the distorted-wave approximation. Numerical calculations for the other atoms were obtained by the present author but are not reproduced in this paper because of "lack of space". It was found that when the distortion of the incident and scattered waves due to the atomic potential are taken into account the maximum of the total cross-section is shifted towards the threshold. The distorted-wave method (without exchange) gives larger values at low energies than the Born method. The monotonic form of the excitation function obtained in these calculations above the threshold is in contradiction to the

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Excitation of Atoms and Ions .. E032/E314

experimental data. This applies to the hydrogen atom. In the case of sodium, for example, and a number of other alkali metals, the excitation function is no longer monotonic but has a number of maxima. The field of the atomic core was calculated in this work with the aid of simple analytical functions of the Slater type. The wave functions for the optical electron were obtained by numerical integration of semi-empirical radial equations with a deformed atomic core, as described by the present author in Ref. 4 (Optika i spektroskopiya, 3, 313, 1957). In all cases except hydrogen, it was necessary to use approximate atomic wave functions. Calculations have shown that the sensitivity of the total cross-section σ to the form of the wave functions is roughly the same as in the case of oscillator strengths. Fig. 2 shows the excitation function on the distorted-wave approximation (σ^{B} is the total Born cross-section; the curve designations are as follows:

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E032/E314

Curve 1 - C^{4+} 2S - 3P; Curve 2 - He, 1S - 2P;
Curve 3 - He, 1S - 6P; Curve 4 - He, 2S - 2P;
Curve 5 - C^{5+}, 2S - 3P). Fig. 3 shows the partial and total excitation cross-sections for the 3S - 3P transition in sodium (the curved marked "σ" shows the total cross-section, "σ^{B}" the total Born cross-section). Acknowledgments are expressed to N.A. Yavlinskiy for interest and assistance in the calculations and to G.G. Dolgov for many discussions. There are 3 figures, 2 tables and 7 references: 3 Soviet and 4 non-Soviet. The three English-language references quoted are: Ref. 2 - I. Percival, M. Seaton - Proc. Cambridge Phil. Soc., 53, 654, 1957; Ref. 5 - H.S.W. Massey - Hanbd. Phys., 36, 389, 1956; Ref. 7 - M.J. Seatou, Proc. Phys. Soc. A68, 457, 1955.

SUBMITTED: October 7, 1960

Card 4/7

6

VAYNSHTEYN, L.A.

a. V.A. FOK L.A. VAYNSHTEYN
VA Fock and LA Vainstein - 'Cross-Sectional Diffusion in Short-Wave Diffraction on Convex Cylinder.'

b. A.L. MIKHAELYAN
AL Michaelyian - 'Phenomenon of Interconnection of Magnetized Ferrite Patterns.'

c. BZ Katsenelenbaum - 'Diffraction on Wide Aperture in Wide-Wave Guide.'

d. YaA Monosov - 'On Theory of Parametric Resonance in Ferrites on UHF.'

GI Makarov - "The Propagation of Electromagnetic Waves in Smooth Ionospheric Layers."

reports to be submitted for the Intl. Symposium on Electromagnetic Theory and Antennas, Copenhagen, Denmark, June 1962.

KAPITSA, Petr Leonidovich, akademik; VAYNSHTEYN, L.A., red.; GUS'KOVA, G.G., red.; GUSEVA, A.P., tekhn. red.

[High-power electronics]Elektronika bol'shikh moshchnostei. Moskva, Izd-vo Akad. nauk SSSR, 1962. 194 p. (MIRA 15:12)
(Microwaves) (Magnetrons)

24.4400

S/051/62/012/004/002/015
E039/E485

AUTHORS: Vaynshteyn, L.A., Poluektov, I.A.

TITLE: Calculations of the oscillator strengths of intercombination transitions using a semi-empirical method

PERIODICAL: Optika i spektroskopiya, v.12, no.4, 1962, 460-465

TEXT: Calculations are made on the field matrix for the spin-orbital and spin-spin magnetic interactions for the sl configuration. Equations are derived from which values of the strength of the oscillator resonance transitions for a series of divalent elements are calculated. These results are compared with experimental data and those obtained using the Pauli-Houston equation (see Table). The equations used are

$$\beta_o = \frac{\sqrt{l(l+1)}}{2l+1} \frac{\varepsilon_{14}}{\varepsilon_{32} - \Delta_o} \qquad (26)$$

(the Pauli-Houston equation)

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and

$$\frac{1}{\beta^2} = \frac{\varepsilon_{32}}{\Delta_o} - 1 \qquad (28)$$

where

$$\Delta_o = \frac{l}{2l + 1}\varepsilon_{14} - \varepsilon_{24}$$

With the exception of Mg, Eq.(28) gives values which compare better with experimental results than Eq.(26). The error obtained using Eq.(28) for the elements Mg, Ca, Sr, Ba increases with decrease in Z number, i.e. with decrease in magnetic interaction. In the case of Mg, Eq.(26) gives a better result. In general, if the magnetic interaction is very small, Eq.(26) should be used. A rigid verification of the condition $\Delta_o \ll M$ is only possible by a direct estimate of the radial integrals which until now are estimated by a semi-empirical method. There are 1 figure and 1 table.

SUBMITTED: March 27, 1961

Table

Element	Z	Transition	f_{30}/f_{20} by Eq.(26)	f_{30}/f_{20} by Eq.(28)	f_{30}/f_{20} by experiment
Mg	12	$3s^2 - 3sp$	357000	107000	470000
Ca	20	$4s^2 - 4sp$	19500	30552	35800
Zn	30	$4s^2 - 4sp$	3995	6805	7200
Sr	38	$5s^2 - 5sp$	1029	1580	1780
Cd	48	$5s^2 - 5sp$	368	579	680
Ba	56	$6s^2 - 6sp$	127	169	164
Hg	80	$6s^2 - 6sp$	29	50.2	47

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B104/B102

24.2400

AUTHOR: Vaynshteyn, L. A.

TITLE: Statistical boundary value problems for a hollow cylinder of finite length. II. Numerical results

PERIODICAL: Zhurnal tekhnicheskoy fiziki, v. 32, no. 10, 1962, 1157-1164

TEXT: The following method of solving electrostatical problems was developed by P. L. Kapitsa, V. A. Fok and L. A. Vaynshteyn (ZhTF, XXIX, no.10 1177, 1959): potential and charge density are expanded in series

$$\left.\begin{aligned} V_s(z) &= \sum_n \varepsilon_n v_n \cos n\psi \\ U_s(z) &= \frac{1}{\pi L \sin\psi} \sum_q u_q \cos q\psi \end{aligned}\right\} \quad (1)$$

where $V_s(z)$ determines the known potential distribution $V(z,\varphi) = \sum_{s=0}^{\infty} V_s(z)\cos s(\varphi - \varphi_s)$ and $U_s(z)$ the unknown surface-charge distribution $S(z,\varphi) = \sum_{s=0}^{\infty} U_s(z)\cos s(\varphi - \varphi_s)$.

The coordinate z has its origin in the center of the cylinder axis and is

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Statistical boundary value ...

directed along it and $z = L\cos\psi$ where $-L < z < L$, $0 < \psi < \pi$. 2L is the cylinder length, 2a its diameter. If $V_s(z)$ is an even function of z then $U_s(z)$ is also an even function of z and n and q in the formulas (1) can assume only even values. To give u_q the infinite system of linear equations $u_n = \sum_q A_{nq} u_q$ (5) is represented in the form

$$u_n = \frac{1}{A_{nn}}\left(v_n - \sum_{q \neq n} A_{nq} u_q\right) \qquad (6)$$

which can be solved by iteration. The elements of the infinite matrix $\| A_{nq} \|$ depend only on the dimensionless parameter $l = L/a$. This method is now simplified for s=0 and s=1; and the simplification enables three electrostatic problems to be solved: 1) A charged cylinder. Expressions are derived in various approximations for its $C_1 = e/2Lv_0$. If $l = 6$, then $C_1 = \pi/lA_{00}$ has an error of 1%. $C_1 = \pi/2l \ln(16/l)$ is obtained if an expression is substituted for A_{00} which holds for $l \ll 1$; the error for $l \leqslant 3$ is less than 2-2.5%, with $l = 3.9$ it is 3.5%. It has been found that as l increases the charge becomes more homogeneously distributed. 2) A cylinder in a longitudinal uniform field. Its polarizability by a longi-

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tudinal electric field is studied. $D = \frac{P}{L^3E_0} = \frac{2}{3}\left(\frac{1}{\Omega_2} + \frac{0.977}{\Omega_2^3}\right)$ is obtained for the dipole moment, where $\Omega_2 = 2(\ln 41 - \frac{7}{3})$. Everywhere except in small sections at the ends of the cylinder the charge is distributed proportionally to z. 3) A cylinder in a transverse uniform field. $D_1 = \frac{P}{a^2LE_0} = 1 + \frac{0.613}{1}$. Since the charge is localized at the edges, the charge distribution can be determined by solving a corresponding problem for a unilaterally bounded cylinder. The calculations were made with a "Ural-1" computer. There are 8 figures.

ASSOCIATION: Institut fizicheskikh problem AN SSSR, Moskva (Institute of Physical Problems AS USSR, Moscow)

SUBMITTED: December 23, 1961

24,2400

S/057/62/032/010/002/010
B104/B102

AUTHOR: Vaynshteyn, L. A.

TITLE: Static boundary value problems for a hollow cylinder of finite length. III. Approximate formulas

PERIODICAL: Zhurnal tekhnicheskoy fiziki, v. 32, no. 10, 1962, 1165-1173

TEXT: Approximate formulas which can be used for computations in electrostatic hollow-cylinder problems are surveyed. The first chapter gives approximate formulas obtained by a method due to P. L. Kapitsa, V. A. Fok, and L. A. Vaynshteyn (ZhTF, XXIX, no. 10, 1177, 1959) as described in a previous paper (Ref. 2: L. A. Vaynshteyn, ZhTF, XXXII, no. 10, 1157, 1962) for a cylinder of finite length. They were modified by the substitution $\xi_0 = 1/\sqrt{1-1/l^2}$ where $l = L/a$ for a prolate ellipsoid of revolution. Capacitance is given by

$$C_1 = \frac{1}{\xi_0 \ln \frac{\xi_0+1}{\xi_0-1}} \approx \frac{1}{2\ln 2l} \qquad (2);$$

polarizability in a homogeneous

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Static boundary ...

longitudinal field by: $D = \frac{1}{3\xi_0^2\left(\frac{\xi_0}{2}\ln\frac{\xi_0+1}{\xi_0-1}-1\right)} \approx \frac{1}{3(\ln 2l - 1)}$ (3); polarizability in a homogeneous transverse field by: $D_1 = \frac{2}{3\left(\xi_0 - \frac{\xi_0^2-1}{2}\ln\frac{\xi_0+1}{\xi_0-1}\right)} \approx \frac{2}{3}$. (4). In the second chapter a variational method is applied to the stationary expression

$$F_s = \frac{\left[\int\limits_{-L}^{L} V_s(z)\,U_s(z)\,dz\right]^2}{2\pi a \iint\limits_{-L}^{L} f_s(z-z')\,U_s(z)\,U_s(z')\,dz\,dz'}$$

(6), by taking account of the integral equation $V_s(z) = \int\limits_{-L}^{L} f_s(z-z')\,U_s(z')\,dz'$, (7). If $l \ll 1$

$$\left.\begin{array}{l} C_1 = \frac{\pi}{lA_{00}},\quad D = \frac{\pi}{2lA_{11}} \quad (s=0), \\ D_1 = \frac{\pi}{lA_{00}} \quad (s=1), \end{array}\right\} (8).$$

If $l \gg 1$, $C_1 = \frac{1}{2(\ln 4l - 1)}$, $D = \frac{1}{3\left(\ln 4l - \frac{7}{3}\right)}$, $D_1 = 1$, (10).

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In the third chapter the following expressions are derived from the integral representation

$$A_{\mu\nu}=\frac{(-1)^{x}}{2\pi^{2}i}\int\limits_{t_0-i\infty}^{t_0+i\infty}\frac{\Gamma(-t)\Gamma(\lambda-t)\Gamma(1+t)\Gamma^{2}\left(\frac{1}{2}+t\right)\Gamma\left(s+\frac{1}{2}+t\right)}{\Gamma(\lambda+1+t)\Gamma(x+1+t)\Gamma(-x+1+t)\Gamma\left(s+\frac{1}{2}-t\right)}\,l^{2t}dt, \quad (11)$$

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$$x=\frac{\mu-\nu}{2},\quad \lambda=\frac{\mu+\nu}{2},\quad -\frac{1}{2}<t_0<0. \quad (12)$$

of the elements of the matrix $\|A_{nq}\|$ (Ref. 2): $A_{00}=\frac{2}{\pi l}\left[(\ln 16l)^{2}+\frac{\pi^{2}}{12}\right]$ (13) and $A_{11}=\frac{2}{\pi l}\left[(\ln 16l-2)^{2}+\frac{\pi^{2}}{12}\right]$ (15). When introduced into the expressions (8), they give $C_1=\frac{\pi^{2}}{2\left[(\ln 16l)^{2}+\frac{\pi^{2}}{12}\right]}$, (14) and $D=\frac{\pi^{2}}{4\left[(\ln 16l-2)^{2}+\frac{\pi^{2}}{12}\right]}$. (16). These interpolation formulas can well be used for medium values of l. In the fourth chapter the Eqs. (10) are transformed into the strongly reduced forms

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$$\left.\begin{aligned} C_1 &= \frac{1}{\Omega_1} + \frac{\varkappa_1}{\Omega_1^3} + \ldots, \\ \Omega_1 &= 2(\ln 4l - 1) = \Omega - 2(1 - \ln 2), \\ \varkappa_1 &= 4 - \frac{\pi^2}{3} = 0.710. \end{aligned}\right\} \quad (30)$$

and

$$\left.\begin{aligned} D &= \frac{2}{3}\left(\frac{1}{\Omega_2} + \frac{\varkappa_2}{\Omega_2^3} + \ldots\right), \\ \Omega_2 &= 2\left(\ln 4l - \frac{7}{3}\right) = \Omega - 2\left(\frac{7}{3} - \ln 2\right), \\ \varkappa_2 &= \frac{31}{9} - \frac{\pi^2}{4} = 0.977. \end{aligned}\right\} \quad (33)$$

by expansion in negative powers of $\Omega = 2\ln(2L/a)$. In the fifth chapter the asymptotic expression $D_1 = 1 + \frac{0.613}{1} - \frac{1}{8l^2}$ is expanded. There are 2 figures.

ASSOCIATION: Institut fizicheskikh problem AN SSSR, Moskva (Institute of Physical Problems AS USSR, Moscow)

SUBMITTED: December 23, 1961

35570
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B102/B138

24.6730

AUTHORS: Kapitsa, S. P., Vaynshteyn, L. A.

TITLE: Radiation deceleration of electron clusters in a microtron

PERIODICAL: Zhurnal eksperimental'noy i teoreticheskoy fiziki, v. 42, no. 3, 1962, 821-830

TEXT: An electron which revolutes with the velocity $c\beta$ in an orbit of radius a is slowed down by a force $F_\varphi = -2e^2\beta^3\gamma^4/3a^2$, which is due to radiation. The radiation power of a finite cluster is $P = N^2 2e^2 c\beta^4\gamma^4\theta/3a^2$, the mean decelerating force is $\overline{F}_\varphi = -N\frac{2e^2}{3a}\beta^3\gamma^4\theta$, both are related by $P = -N\overline{F}_\varphi c\beta$. These simple relations are used to calculate the coherence and the radiation deceleration effect on the electron motion in a microtron. It is also determined for which N the radiation deceleration will cause an electron leakage from the accelerating orbit. Calculations are made for ultrarelativistic electrons with $\beta \approx 1$ and $\gamma^2 \gg 1$. The coherence coefficient θ is calculated by two methods. For a thin

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circular beam of N electrons the general relation

$$\Theta = -\frac{3}{2\beta^3\gamma^4}\int_0^{2\pi} G'(\chi)\frac{1-\beta^2\cos\psi}{2|\sin\psi/2|(1-\beta\cos\psi/2)}d\chi \doteq$$
$$= -\frac{3}{2\beta^2\gamma^4}\int_{-\pi}^{\pi} G'(\chi)\frac{1-\beta^2\cos\psi}{2|\sin\psi/2|}d\psi, \qquad (34)$$

with $G(\chi) = \int_{-\pi} g(\chi - \mu)g(\mu)d\mu$ and $\psi - 2\beta|\sin\psi/2| = \chi$, is obtained, which holds for any β. For $\beta \simeq 1$ and a short cluster ($\chi_0 \ll 1$)

$$\Theta = \frac{1}{4s^3}\int_0^\infty H\left(\frac{\tau+\tau^3/12}{2s}\right)\left(\tau^2+\frac{\tau^4}{8}\right)d\tau, \qquad (40)$$

$$s = \gamma^3\chi_0 = \gamma^3 r_0/a \text{ и } \tau = \gamma\psi. \qquad (41)$$

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Radiation deceleration of electron ...

which, in the case of a homogeneous beam can be written as

$$\theta = \frac{t^3}{8s^3}\left[1+\frac{3t^2}{40}-\frac{9t}{32s}\left(1+\frac{5t^2}{36}+\frac{t^4}{192}\right)+\frac{t^3}{256s^3}\left(1+\frac{9t^2}{32}+\frac{t^4}{32}+\frac{11t^6}{6912}+\frac{t^8}{35148}\right)\right], \tag{43}$$

with $s = (t+t^3/12)/4$ for the distribution $H(u) = \frac{3}{2}(1 - \frac{3u}{4} + \frac{u^3}{16})$ if $0 < u < 2$ and $H(u) = 0$ if $u > 2$. For $H(u) = 1/4u$ if $0 < u < 2$ and $H(u) = 0$ if $u > 2$ $\theta = \frac{3}{8s^2}\left[\frac{t^2}{4} - \ln(1+t^2/12)\right]$. The upper limit of the particle current in the microtron, determined by the coherent radiation forces, is estimated to be: $J_{max}/J_1 = 1/\sigma^3$ with $J_1 = \frac{3J_0}{8\pi^3}(-\delta\varphi)_{max} = 32$ a; $J_0 = mc^3/e$. The limiting current reaches ~ 1 a. In the authors' Institute the microtron current reaches 25 ma. At these currents the radiation deceleration has

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no effect on the operation of the microtron. Only for 15 - 30 fold currents would an effect be observed. M. S. Rabinovich and V. P. Bykov are thanked for remarks. There are 3 figures and 9 Soviet references.

ASSOCIATION: Institut fizicheskikh problem Akademii nauk SSSR (Institute of Physical Problems of the Academy of Sciences, USSR)

SUBMITTED: September 21, 1961

KELDYSH, M.V., akademik; FEDOROV, Ye.K., akademik; ARTSIMOVICH, L.A., akademik; SISAKYAN, N.M., akademik; GORSKIY, I.I.; KAPITSA, P.L.; FOK, V.A.; LANDAU, L.D.; LIFSHITS, Ye.M.; SHAL'NIKOV, A.I.; KHALATNIKOV, I.M.; ALEKSEYEVSKIY, N.Ye.; VAYNSHTEYN, L.A.; PALLADIN, A.V., akademik; SATPAYEV, K.I., akademik; AMBARTSUMYAN, V.A., akademik; KUPREVICH, V.F.; MUSKHELISHVILI, N.I., akademik; KARAKEYEV, K.K.; MUSTEL', E.R.; MASEVICH, A.G., doktor fiz.-matem.nauk; EFRON, K.M.; MARTYNOV, D.Ya., prof.; GRIGOR'YEV, A.A., akademik; MARKOV, K.K., prof.; GOLOVKOVA, A.G., prof.; FILATOVA, L.G., prof.; FEYVE, Ya.V.; SEMIKHATOV, B.N., prof.; TITOV, A.G.; RYCHAGOV, G.I.; BARSKAYA, V.F.; VLASOVA, A.A.; BARANOVA, Ye.P.; KIBARDINA, L.A.; ISACHENKO, A.F.; IL'INA, Yu.P.; DANILOV, A.I., prof.; FLAUDE, K.K.; NECHAYEVA, T.N., prof.; CHEPEK, L., doktor; SZANTO, Ladislav, akademik; BELACHIK, Yozef; FAN KUOK V'YEN; EYGENSON, M.S., prof. (L'vov); STARKOV, N.; ABRAMOVICH, Yu.; VOSKRESENSKIY, V.; KROPACHEV, A.; REZVOY, D., prof., (L'vov); KONDRAT'YEV, V.N., akademik; LEBEDINSKIY, V.I., kand.geol.-mineral.-nauk; YANSHIN, A.L., akademik

"Priroda" is 50 years old. Priroda 51 no.1:3-16 Ja '62. (MIRA 15:1)

1. Prezident AN SSSR (for Keldysh). 2. Glavnyy uchenyy sekretar' Prezidiuma AN SSSR (for Fedorov). 3. Akademik-sekretar' Otdeleniya fiziko-matem.nauk AN SSSR (for Artsimovich). 4. Akademik-sekretar' Otdeleniya biologicheskikh nauk AN SSSR (for Sisakyan). 5. Chlen-korrespondent AN SSSR, zamestitel' akademika-sekretarya Otdeleniya

~~(Continued on next card)~~

PRESNYAKOV, L., SOBELMAN, I.I., VAYNSHTEYN, L.A.

"One model for calculation of excitation cross sections for atoms."

Report submitted to the Third Intl. Conf. on the Physics of Electronics and Atomic Collisions, London, England 22-26 July 1963

ACCESSION NR: AT4015870 S/3055/63/000/002/0026/0056

AUTHOR: Vaynshteyn, L. A.

TITLE: On the electrodynamic theory of gratings. I. Ideal grating in free space.

SOURCE: AN SSSR. Fizicheskaya laboratoriya. Elektronika bol'shikh moshchnostey (High-power electronics), no. 2, 1963, 26-56

TOPIC TAGS: grating, ideal grating, grating in free space, boundary condition, transmission coefficient, reflection coefficient, wire grating, ribbon grating, conformal mapping, H mode, surface H wave

ABSTRACT: This investigation was stimulated by the contradiction between some of the latest results (Waveguide Handbook, MIT Radiation Lab. Series, McGraw Hill, 1951), and some of the earlier classical works (H. Lamb, Hydrodynamics, Dover, N. Y., 1945). The passage of electromagnetic waves with different polarizations through a periodic grating of perfectly conducting infinite cylindrical conductors

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ACCESSION NR: AT4015870

is considered. The boundary conditions are formulated for the magnetic fields to calculate the reflection and transmission coefficients of the waves for a grating whose period is small compared with the wavelength. The physical meaning of the boundary conditions is explained. The analogy with hydrodynamics is pointed out and conformal mapping is used in the computation. The parameters involved in the boundary conditions are calculated for round and ribbon grating elements as functions of the density of the grating. It is shown that the boundary conditions for H modes is made complicated by the fact that surface H-waves can propagate across the grating. Orig. art. has: 3 figures and 128 formulas.

ASSOCIATION: Fizicheskaya laboratoriya AN SSSR (Physics Laboratory, AN SSSR)

SUBMITTED: 00 DATE ACQ: 25Jan64 ENCL: 00

SUB CODE: GE, SD NO REF SOV: 012 OTHER: 002

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ACCESSION NR: AT4015871 S/3055/63/000/002/0057/0074

AUTHOR: Vaynshteyn, L. A.

TITLE: On the electrodynamic theory of gratings. II. Allowance for finite conductivity

SOURCE: AN SSSR. Fizicheskaya laboratoriya. Elektronika bol'shikh moshchnostey (High-power electronics), no. 2, 1963, 57-74.

TOPIC TAGS: grating, grating with finite conductivity, grating in free space, boundary condition, transmission coefficient, reflection coefficient, wave resistance, Leontovich boundary condition

ABSTRACT: This is a continuation of the preceding paper in the same collection, and deals with gratings made of elements having finite conductivity. The Leontovich boundary conditions and perturbation theory are used to calculate the boundary conditions for such a grating, and the physical meaning of the boundary conditions

ACCESSION NR: AT4015871

is explained. The boundary conditions differ from those with infinite conductivity in that they contain terms proportional to the wave resistance of the conductor material. "The author is grateful to P. L. Kapitsa and V. A. Fok for interest in this work." Orig. art. has: 3 figures, 72 formulas, and 1 table.

ASSOCIATION: Fizicheskaya laboratoriya AN SSSR (Physics Laboratory, AN SSSR)

SUBMITTED: 00 DATE ACQ: 25Jan64 ENCL: 00

SUB CODE: GE, SD NO REF SOV: 003 OTHER: 001

S/3055/63/000/002/0075/0082

ACCESSION NR: AT4015872

AUTHOR: Vaynshteyn, L. A.

TITLE: Normal coordinates in the theory of closed resonant network loops

SOURCE: AN SSSR. Fizicheskaya laboratoriya. Elektronika bol'shikh moshchnostey (High-power electronics), no. 2, 1963, 75-82

TOPIC TAGS: multicavity magnetron, closed network loop, resonant network, normal coordinate, generalized coordinate, generalized Lagrangian, cyclic coordinate, equivalent circuit method, natural oscillation modes

ABSTRACT: The natural oscillation modes of a complex resonant system made up of identical elements and represented by a set of generalized cyclic coordinates (such as the resonant system of a multicavity magnetron) are determined in general form, neglecting

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ACCESSION NR: AT4015872

losses, by starting with the general Lagrangian in which the magnetic and electric energies are quadratic forms. The conclusions arrived at are the same as are usually obtained by the method of equivalent circuits, but the presentation is claimed to be physically clearer. "The author is grateful to P. L. Kapitsa for a valuable discussion of the problems considered in this article." Orig. art. has: 5 figures and 17 formulas.

ASSOCIATION: Fizicheskaya laboratoriya AN SSSR (Physics Laboratory AN SSSR)

SUBMITTED: 00 DATE ACQ: 25Jan64 ENCL: 00

SUB CODE: GE, SD NO REF SOV: 000 OTHER: 002

Card 2/2

ACCESSION NR: AT4015873 S/3055/63/000/002/0083/0097

AUTHOR: Vaynshteyn, L. A.

TITLE: On the theory of contactless plunger

SOURCE: AN SSSR. Fizicheskaya laboratoriya. Elektronila bol'shikh moshchnostey (High-power electronics), no. 2, 1963, 83-97

TOPIC TAGS: transmission line plunger, coaxial line plunger, reactive plunger, contactless plunger, telegraphy equation analysis, electrodynamic diffraction analysis, approximate calculation, rigorous calculation

ABSTRACT: Contactless (reactive) plungers in coaxial lines, which provide almost complete reflection in some frequency band without making direct contact between the inner and outer conductors, are analyzed both on the basis of the telegraphy equation and on the basis of rigorous electrodynamic calculations of the diffraction on

ACCESSION NR: AT4015873

the end of the plunger. The behavior of the coaxial line plus plunger system is discussed for several configurations of the coaxial line, the plunger, and short circuiting partitions in the system. The correction factors necessary to reconcile the telegraphy-equation theory with the electrodynamic diffraction theory are derived. "The author is grateful to P. L. Kapitsa for suggesting the topic and to S. P. Kapitza for valuable discussions. Orig. art. has: 6 figures and 46 formulas.

ASSOCIATION: Fizicheskaya laboratoriya AN SSSR (Physics Laboratory, AN SSSR)

SUBMITTED: 00 DATE ACQ: 25Jan64 ENCL: 00

SUB CODE: GE, SD NO REF SOV: 004 OTHER: 000

Card 2/2

ACCESSION NR: AT4015874 S/3055/63/000/002/0098/0108

AUTHORS: Vaynshteyn, L. A.; Petrusevich, Yu. M.; Prozorova, L. A.

TITLE: Diaphragms for H_{01} mode in a round waveguide

SOURCE: AN SSSR. Fizicheskaya laboratoriya. Elektronika bol'shikh moshchnostey (High-power electronics), no. 2, 1963, 98-108

TOPIC TAGS: waveguide, diaphragmed waveguide, round diaphragmed waveguide, H_{01} mode, coupled cavities, coupling coefficient, resonant frequency splitting, transmission coefficient

ABSTRACT: The transmission coefficient of the H_{01} mode in a round waveguide through a transverse metallic partition with a small circular opening is calculated. A connection is established between the transmission coefficient and the coupling coefficient between two cylindrical cavities, in which the H_{01} modes interact via a round

ACCESSION NR: AT4015874

hole in the common end wall. A procedure is described for measuring the frequency of the coupled oscillations in such resonators. The measured values of coupling coefficient, which determines the splitting of the resonant frequency, are compared with the calculations. The theoretical curve for the variation of the ratio of hole radius to the waveguide radius with the frequency deviation lies somewhat higher than the experimental curve, the difference between them not exceeding 15%. "The authors are grateful to P. L. Kapitsa for suggesting the topic and to S. P. Kapitsa for valuable advice." Orig. art. has: 5 figures and 39 formulas.

ASSOCIATION: Fizicheskaya laboratoriya AN SSSR (Physics Laboratory, AN SSSR)

SUBMITTED: 00 DATE ACQ: 25Jan64 ENCL: 02

SUB CODE: GE, SP NR REF SOV: 000 OTHER: 000

Card 2/4

S/2910/63/003/01-/0119/0127

ACCESSION NR: AT4041502

AUTHOR: Vaynshteyn, L. A.

TITLE: Elastic scattering and free-free transitions of electrons in the field of the hydrogen atom

SOURCE: AN LitSSR. Litovskiy fizicheskiy sbornik, v. 3, no. 1-2, 1963, 119-127

TOPIC TAGS: electron scattering, elastic scattering, electron transition, free-free transition, hydrogen atom, hydrogen atom field, radial wave function, quantum mechanics, adiabatic approximation, plasma radiation, Fock Hartree potential, polarization potential

ABSTRACT: Free-free electron transitions play an important part in the formation of low-temperature plasma radiation. The probability of the photo-transition of an electron can be expressed through matrix elements of the radius vector, momentum, and acceleration. In the present paper, the radial matrix element with a special convergence scheme is chosen. In a single-electron approximation, the effective cross-section of the absorption of a quantum with energy $\Delta \varepsilon = k_1^2 - k_0^2$ as a result of free-free transition is written as

$$\sigma_{01} = \frac{8\pi^2 a_0^5}{137\, k_0 k_1} \sum_{L_0^T L_1^T l_0 l_1} \{ Q_{01}^+ R_{01}^+ + Q_{01}^- R_{01}^- \}, \qquad (1)$$

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ACCESSION NR: AT4041502

where the radial part is

$$R^{\pm}_{01} = \frac{\Delta\epsilon}{3}\rho^{2}_{01} = \frac{\Delta\epsilon}{3}\left[\int_0^{\infty} F_0^{\pm}(r)\,F_1^{\pm}(r)\,r\,dr\right]^2, \tag{2}$$

and $F_0^{\pm}(r)$ and $F_1^{\pm}(r)$ are radial functions of the elastic scattering of electrons in an atomic field. The differential equation for F(r), which contains the Fock-Hartree potential, U(r), and the polarization potential, V(r), is solved by successive approximations using adiabatic approximation for V(r). From this solution, expressions for scattering amplitude, $A^{\pm}_{l}$, and partial cross-section are obtained. Results of computations are given for $A^{\pm}_{l}$, for l = 0, 1, 2 and for energies from 0 to 9 ev: with exchange and polarization, without polarization, and without exchange and polarization. Partial cross-sections are shown in Fig. 1 and full cross-sections in Fig. 2 of the Enclosure. The radial integral ρ_{01} for these transitions contains divergent parts. By writing the integral as the sum of 2 parts, the convergent part is evaluated by integration and the divergent part is evaluated numerically. Tables of R^{+}_{01} (symmetric transition) and R^{-}_{01} (antisymmetric transition)

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are given for s - p and p - s transitions up to 5 ev. Another table gives R_{01} computed from a simplified equation by Ohmura (Astroph. J., 131, 8, 1960) for comparison. Discrepancies of about 10% exist but are not elaborated upon. Orig. art. has: 2 figures, 4 tables and 19 equations.

ASSOCIATION: Fizicheskiy institut im. P. N. Lebedeva Akademii Nauk SSSR, Moscow (Institute of Physics, SSSR Academy of Sciences)

SUBMITTED: 00

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SUB CODE: GP

NO REF SOV: 004

OTHER: 004

Card 3/5

ACCESSION NR: AT4041502

ENCLOSURE: 01

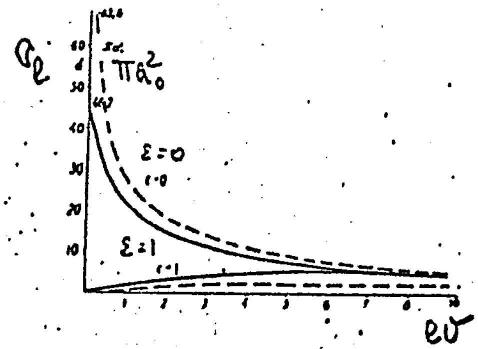

Fig. 1 - Partial cross-sections of the plastic scattering of electrons by a hydrogen atom: ______ computed with allowance for exchange and polarization, - - - computed with allowance for exchange but without polarization.

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ACCESSION NR: AT4041502

ENCLOSURE: 02

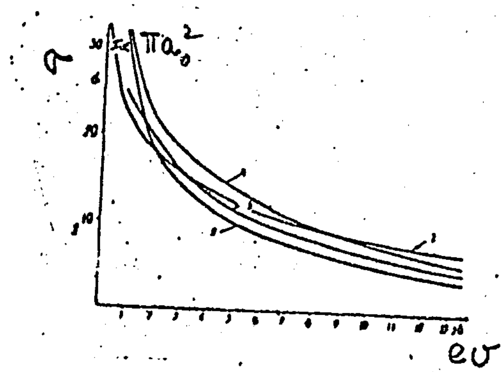

Fig. 2 - Complete cross-sections of the elastic scattering of electrons by a hydrogen atom computed according to: 1) The author's method with exchange and polarization. 2) The author's method with exchange but without polarization. 3) Temkin and Lamkin (Phys. Rev., 121, 788, 1961). 4) Bransden et. al. (Proc. Phys. Soc., 71, 877, 1958).

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S/109/63/008/003/001/027
D413/D308

AUTHORS: Fok, V. A., and Vaynshteyn, L. A.

TITLE: Transversal diffusion in the diffraction of short waves on a convex cylinder with smoothly varying curvature. Part I

PERIODICAL: Radiotekhnika i elektronika, v. 8, no. 3, 1963, 363-376

TEXT: L. A. Vaynshteyn and G. D. Malyuzhinets (Radiotekhnika i elektronika, v. 6, no. 8, 1961, 1247; v. 6, no. 9, 1961, 1489) have derived a general asymptotic solution of the two-dimensional diffraction problem for a circular cylinder of large radius; the authors consider how to extend this solution to any arbitrary convex cylinder whose radius of curvature is large compared with the wavelength and varies smoothly. They reject a solution postulated by analogy with the formula for the circular cylinder because it cannot be justified mathematically; by neglecting the

S/109/63/008/003/001/027
D413/D308

Transversal diffusion...

longitudinal diffusion term, which can be shown to be small under the given conditions, they reduce the wave equation to an equation of parabolic type expressed in radial coordinates and consider substitutions which simplify its integration. In the particular case where the contour of the cylinder along the path of the diffraction wave is a segment of a spiral whose radius of curvature is proportional to the cube of the arc length measured from the focus, an exact separation of the variables in the parabolic equation is possible; by applying a generalized locality principle for expressing the incident wave, it is possible to obtain a unique asymptotic expression for the two-dimensional Green function which is valid in both umbra and penumbra at any distance from the surface of the cylinder. This result is in agreement with results obtained by W. Franz and K. Klante (IRE Trans., 1959, AP-7, Spec. Suppl., 68-70), and also J. B. Keller and B. R. Levy (IRE Trans., 1959, AP-7, Spec. Suppl., 52-61). Some consequences for plane-wave diffraction are examined, and possibilities for generalizing the results are discussed. The

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Transversal diffusion... S/109/63/008/003/001/027
D413/D308

authors thank G. D. Malyuzhinets for his advice. There are 5 figures.

ASSOCIATION: Institut fizicheskikh problem AN SSSR (Institute of Physical Problems, AS USSR)

SUBMITTED: September 11, 1962

Card 3/3

S/109/63/008/003/002/027
D413/D308

AUTHORS: Fok, V. A., and Vaynshteyn, L. A.

TITLE: Transversal diffusion in the diffraction of short waves on a convex cylinder with smoothly varying curvature. Part II

PERIODICAL: Radiotekhnika i elektronika, v. 8, no. 3, 1963, 377-388

TEXT: Starting from the parabolic equation obtained in Part I (Radiotekhnika i elektronika, v. 8, no. 3, 1963, 363), the authors derive an asymptotic solution to the two-dimensional problem of the diffraction of a cylindrical wave on an arbitrary convex cylinder for any positions of the source and point of observation in relation to the cylinder. The assumptions are that the radii of curvature are large compared with the wave-length, that the curvature varies relatively slowly, and that the cylinder either is ideally reflecting or has an impedance parameter related in a certain manner to the curvature. Two expres-

Card 1/2

sions are obtained whose zones of validity overlap and which, between them, cover the whole of the umbra and penumbra regions; they are quite different from the solution that could be postulated by analogy with the case of the circular cylinder (see Part I) and are shown to be much more accurate. There are 2 figures.

ASSOCIATION: Institut fizicheskikh problem AN SSSR (Institute of Physical Problems, AS USSR)

SUBMITTED: September 11, 1962

VAYNSHTEYN, L.A.

Radiation of charges in circular motion. Radiotekh. i elektron. 8 no.10:1698-1705 O '63. (MIRA 16:10)

1. Institut fizicheskikh problem AN SSSR.

L 17809-63 EWA(k)/EWP(k)/EWT(1)/BDS/EEC(b)-2/ES(t)-2 AFFTC/
ASD/ESD-3/RADC/APGC/AFWL/IJP(C)/SSD/3W2 Pi-4/Pf-4 GG/JHB/WG/K

ACCESSION NR: AP3007092

S/0056/63/045/003/0684/0697

79

78

AUTHOR: Vaynshteyn, L. A.

TITLE: Open cavities with spherical mirrors 21

SOURCE: Zh. eksper. i teoret. fiziki, v. 45, no. 3, 1963, 684-697

TOPIC TAGS: laser, laser mirror, laser mirror configuration, laser oscillations, laser cavity, laser cavity oscillations, focused mirror configuration, open cavity

ABSTRACT: A theoretical study of electromagnetic oscillations in an open cavity formed by two identical circular or rectangular mirrors of spherical curvature positioned opposite each other in a vacuum has been carried out. Mirror curvature radii and intermirror distance are arbitrary. It is shown that natural oscillations can occur in such a cavity with very small radiative losses. Each of these modes can be interpreted as a set of rays reflected alternately by the mirrors and restricted by dielectric surfaces. The wave field is considered in a spheroidal system of coordinates corresponding to cavity geometry, and the problem is handled by the

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L 17809-63

ACCESSION NR: AP3007092

integration of parabolic equations yielding asymptotic solutions of diffraction problems. Simple formulas are obtained for the oscillation frequencies and field distributions. The evolution of natural oscillations with a change of mirror curvatures from plane to concentric configurations is traced. It is shown that the smallest radiative losses occur in a cavity with focused mirrors (radius of curvature of the mirrors equal to the distance between them). Orig. art. has: 3 figures and 88 equations.

ASSOCIATION: Institut fizicheskikh problem Akademii nauk SSSR (Institute of Physical Problems, Academy of Sciences SSSR)

SUBMITTED: 09Mar63 DATE ACQ: 08Oct63 ENCL: 00

SUB CODE: PH NO REF SOV: 002 OTHER: 005

Card 2/2

AID Nr. 985-13 7 June

OPEN CAVITIES FOR LASERS (USSR)

Vaynshteyn, L. A. Zhurnal eksperimental'noy i teoreticheskoy fiziki, v. 44, no. 3, Mar 1963, 1050-1067. S/056/63/044/003/039/053

A theory of open cavities is developed which is based on the strict theory of diffraction at the open ends of waveguides. Natural oscillations of plane- and cylindrical-waveguide sections and of cavities formed by rectangular or circular mirrors are considered. Simple approximate formulas with a direct physical interpretation are obtained. The precision of the formulas increases with an increase in the frequencies considered and decrease in radiative attenuation. Natural frequencies, radiative attenuation, current distribution at the walls, additional damping as a result of joule losses or partial transparency of the walls, and electric and magnetic field distribution in the cavity are calculated. The theory is applicable to laser engineering and to the physics and technology of millimeter and submillimeter waves. [BB]

Card 1/1

AUTHOR: Vaynshteyn, L.A.

TITLE: Ex

tions do not exhaust
tasks concerning open resonator systems, the author studies (in the article
the excitation of monochromatic oscillations and the

starting from Maxwell's equations [illegible] formulas.

of the natural oscillations of the electron cloud, and (2)
to: (1) the dielectric effect of the electron cloud caused by the action of
ing" effect produced by the drift of the electron cloud
the static fields. It was shown that for small variations of the static fields,

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ACCESSION NR: AT4047274

relative instability of the static fields since the frequency pulling factor is, as a rule, small. The relations obtained show that the highest frequency stability is obtained when the phase velocity of the resonator wave is equal to the drift velocity of electrons, i.e., when the power generated and the amplitude of the

AUTHOR: Vaynshteyn, L.A.

TITLE. Diffraction in open resonat[illegible] with confocal mirrors

[illegible] doklado v. Moscow, 1964, 185-186

TOPIC TAGS: open resonator diffraction, open resonator damping, mirror resonator, [illegible]

[illegible] cylindrical mirrors. This led to the study of the integral equation

$$f(t) = \sqrt{\frac{c}{2\pi}}\, e^{i\left(\cdot - \frac{\pi}{4}\right)} \int e^{ictt'} f(t')\, dt' \qquad (1)$$

[illegible] (2)

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L 55068-65

ACCESSION NR: AT5013935

ASSOCIATION: None

SUBMITTED: [illegible]

[illegible]

Card 3/3

SOURCE: AN SSSR. Fizicheskaya laboratoriya. Elektronika bol'shikh moshchnostey, no. 3, 1964, 176-215

total internal reflection, ... tion of caustic surfaces. The theory of natural oscillations in open cylindrical (a section of an infinitely thin tube) and barrel-shaped resonators is presented. ... azimuthal order m are

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ACCESSION NR: AT4041271

... were investigated in ...

... The author thanks P. L. Kapitsa for his interest in the work, and S. P. Kapitsa for valuable discussions of the problem." Orig. art. has: 5 figures and 183 formulas.

ASSOCIATION: none

TOPIC TAGS: wave diffraction, plane wave diffraction, wave diffraction by el[illegible]

ABSTRACT: [illegible]

APPROVED FOR RELEASE: 08/31/2001 CIA-RDP86-00513R001859120009-6"

effect, strong coupling, atom

ABSTR..T: Although numerous approximate methods have been proposed in the past for

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ACCESSION NR [illegible]

approximation taking into account strong coupling effects were compared. Atomic radial functions were obtained [illegible]

APPROVED FOR RELEASE: 08/31/2001 CIA-RDP86-00513R001859120009-6"

ACCESSION NR: AP4013403 S/0057/64/034/002/0193/0204

AUTHOR: Vaynshteyn, L.A.

TITLE: Diffraction in open resonators and open waveguides with plane reflectors

SOURCE: Zhurnal tekhn.fiz.,v.34, no.2, 1964, 193-204

TOPIC TAGS: microwave, resonator, open resonator, open waveguide, diffraction

ABSTRACT: An open resonator consisting of two plane-parallel reflectors mounted opposite each other is discussed theoretically on the basis of the parabolic equation proposed by M.A.Leontovich and V.A.Fok (Izv.AN SSSR,Ser.fiz.,8,No.1,16-22,1944; ZhETF,16,No.7,557-573,1946) for analyzing wave propagation. When this equation is employed, the second derivative of the wave amplitude with respect to the coordinate perpendicular to the reflectors is neglected, and the approximation is assumed to be equivalent to treating the diffraction by Huygens' principle. An integral equation is derived for the current in the reflectors. This equation was solved exactly by the Wiener-Hopf-Fock method for the case of infinite half-plane reflectors. With the aid of this solution, an approximate solution is derived for the case of infinitely long reflectors of finite width. This approximate solution is said to agree satis-

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AP4013403

factorily with the numerical solution of the integral equation published by A.G.Fox and T.Li (Bell System Techn.J.,40,No.2,453-488,1961). The solution of the integral equation gives the frequencies of the resonant modes and their damping by radiation loss. Finite resonators with rectangular and circular reflectors are discussed. The rectangular case is reduced to the two-dimensional case discussed above by separation of variables. The circular case is treated on the assumption that the large (compared with the wavelength) radius of the reflector makes it possible to employ the reflectinn coefficient previously derived for semi-infinite planes. In each case the frequencies of the resonant modes and their damping by radiation loss are obtained. An open waveguide is discussed. This consists of a number of off-set plane-parallel reflectors which successively reflect the transmitted waves so that they follow a zig-zag path. A relation is derived between the open waveguide and a corresponding open resonator, and this is employed to obtain the propagating frequencies and radiation losses in the waveguide. This relation is shown to persist if the reflectors, while remaining identical, are no longer plane. The open resonators and waveguides have the advantage at very short wavelengths over cavity resonators and closed waveguides that their resonant (or propagating) frequencies are more widely separated. Orig.art.has: 80 formulas and 3 figures.

AP4013403

ASSOCIATION: Institut fizicheskikh problem AN SSSR, Moscow (Institute of Physical Problems, AN SSSR)

SUBMITTED: 04Jan63 DATE ACQ: 26Feb64 ENCL: 00

SUB CODE: PH NR REF SOV: 007 OTHER: 001

Card 3/3

S/0057/64/034/002/0205/0217

ACCESSION NR: AP4013404

AUTHOR: Vaynshteyn, L.A.

TITLE: Open resonators with cylindrical reflectors

SOURCE: Zhurnal tekhn. fiz., v,34, no.2, 1964, 205-217

TOPIC TAGS: microwave, resonator, open resonator, cylindrical open resonator, concave reflector, diffraction

ABSTRACT: An open resonator consisting of two identical concave cylindrical reflectors facing each other is treated theoretically. The concave reflectors are portions of the same elliptic cylinder, as shown in Figure 1 of the Enclosure. The calculations are performed in elliptic coordinates ξ, ζ, related to the rectangular coordinates x, z, by

$$x = d \operatorname{ch}\zeta \sin\xi, \quad z = d \operatorname{sh}\zeta \cos\xi,$$

The differential equation for the wave amplitude is reduced to parabolic form by neglecting the second derivative of the amplitude with respect to ζ and replacing sin ξ by ξ. This latter approximation is valid provided the width of the reflectors is

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AP4013404

small compared with the geometric mean of their radius of curvature and the distance between them. The simplified wave equation is reduced by a change of variable to the time dependent Schrödinger equation for a harmonic oscillator, in which a longitudinal coordinate plays the role of time. The frequencies of the resonant modes and their damping by radiation loss are calculated for an infinitely long resonator. The field is confined between caustics, and the radiation loss is very small. The above treatment is not valid for the case of two coaxial cylindrical reflectors, since not all the conditions are met which are required for the validity of the approximations involved. With the aid of the Green's function, however, this case is shown to be simply related to the case of two plane reflectors, previously treated by the author (L.A.Vaynshteyn,ZhTF,34,No.2,p.193; see abstract ACC NR AP4013403). When the reflectors are coaxial a caustic is not formed and the radiation loss is the same as with plane reflectors. The discussion of a resonator with cylindrical reflectors of finite length is reduced by a separation of variables to the case of infinitely long cylindrical reflectors, treated above, and that of plane reflectors, treated earlier (loc.cit.supra). In this case the radiation loss is mainly from the ends of the resonator, i.e., in the direction of the generators of the cylinders, and the loss from the sides (in those cases in which a caustic is present) is very small. A scalar wave function was employed in the above calculations. This is replaced by a

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AP4013404

component of the electromagnetic vector potential, and the field configurations in the electromagnetic case are discussed. It is asserted that an open resonator with spherical reflectors can be treated analogously. Orig.art.has: 87 formulas and 4 figures.

ASSOCIATION: Institut fizicheskikh problem AN SSSR, Moscow (Institute of Physical Problems, AN SSSR)

SUBMITTED: 04Jan63 DATE ACQ: 26Feb64 ENCL: 01

SUB CODE: PH NR REF SOV: 008 OTHER: 006

Card 3/4 3

VAYNSHTEYN, L. A.

AUTHOR: Vaynshteyn, L.A.

TITLE: Excitation of open resonators

SOURCE: Zhurnal tekhnicheskoy fiziki, v.34, no.9, 1964, 1541-1555

ABSTRACT: The ... of an open resonator consisting of perfectly ... is treated by expansion in terms of the continuous spectrum eigenfunctions of the resonator.

L [illegible]-65
ACCESSION NR: AP4045263

[illegible] with subsequent defor-
[illegible]
[illegible] for emp-
[illegible]
is discussed and the normalizing factor for the eigenfunction of a resonator con-
[illegible]
appears to be consistent in that no obvious paradoxes have arisen, the author is
[illegible]

103 formulas and 4 figures.

ASSOCIATION: Institut fizicheskikh [illegible] (Institute of Physical Problems, AN SSSR)

SUBMITTED: 01Nov63

ENCL: 00

SUB CODE: EC, MA

NR REF SOV: 013

OTHER: 001

2/2

TITLE: Geometrical optics of open resonators

SOURCE: Zh. eksper. i teor. fiz., v. 47, no. 8, 1964, 508-517

TOPIC TAGS: resonator, optical maser, cavity resonator, quantum generator, [illegible]ser mode ex[illegible]

ABSTRACT: In order to trace the connection between geometrical optics and the theory of open resonators, the authors consider two-[illegible] reflections from ellip- [illegible] particular [illegible]

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SUB CODE: OP, EC NO REF SOV: 006 OTHER: 000

APPROVED FOR RELEASE: 08/31/2001 CIA-RDP86-00513R001859120009-6"

L 23383-66 EWT(1)

ACC NR: AT5027155 SOURCE CODE: UR/3055/65/000/004/0093/0105

AUTHOR: Vaynshteyn, L. A. (Professor)

ORG: none

20
B+1

TITLE: Beam flows in a three-axis ellipsoid

SOURCE: AN SSSR. Fizicheskaya laboratoriya. Elektronika bol'shikh moshchnostey, no. 4, 1965, 93-105

TOPIC TAGS: electron diffraction, resonator, open resonator

ABSTRACT: Natural oscillations in a perfect-reflection three-axis ellipsoid are investigated by means of an asymptotic integration of Lamé's wave equations. These natural oscillations are represented by beam flows delimited by caustic surfaces and obeying quantum rules. This analytical investigation corroborates the results of a geometrical investigation of the same problem by V. P. Bykov (same issue, page 66). The wave approach to the problem permits developing approximate formulas for field distribution and determining the continuous transition of one mode of oscillations into another. The examined conditions can be materialized in an open resonator whose reflecting surface is a part of an ellipsoid. "The author wishes to thank P. L. Kapitsa for his valuable comments." Orig. art. has: 2 figures and 42 formulas.

SUB CODE: 09 / SUBM DATE: 26Jun64 / ORIG REF: 005 / OTH REF: 002

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L 23386-66 EWT(1) IJP(c) AT

ACC NR: AT5027156 SOURCE CODE: UR/3055/65/000/004/0106/0129

22

B+1

AUTHOR: Vaynshteyn, L. A. (Professor)

ORG: none

21,445

TITLE: Diffraction in open resonators with confocal mirrors. — Part 1

SOURCE: AN SSSR. Fizicheskaya laboratoriya. Elektronika bol'shikh moshchnostey, no. 4, 1965, 106-129

TOPIC TAGS: electron diffraction, resonator, open resonator, confocal mirror resonator

ABSTRACT: An integral equation describing diffraction characteristics of a resonator can be reduced to a linear differential equation (for spheroidal wave functions) in the case of an open resonator with confocal cylindrical mirrors or with confocal rectangular spherical mirrors (i.e., when the mirror radius of curvature is equal to the distance between the mirrors). This differential equation is integrated asymptotically, by using the method of standard equations, and explicit formulas are developed for current distribution over the mirrors and for radiation loss. The

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L 23386-66

ACC NR: AT5027156

diffraction loss is expressed through a quantity $\Lambda = 4 \quad p''$, where p'' also enters a complex quantity $p = p' - ip''$, i.e., the energy radiated during $\tau = 2l/c$; $c = ka^2/2$; $2l$ is the distance between the mirrors. Plots of Λ vs. c are presented. The complex natural frequency can be calculated from these formulas:

for resonators with cylindrical confocal mirrors, $\frac{2kl}{\pi} = q + \frac{m}{2} + \frac{1}{4} - i\frac{\Lambda}{2\pi}$;

for resonators with square spherical mirrors, $\frac{2kl}{\pi} = q + \frac{m+n+1}{2} - i\frac{\Lambda}{\pi}$.

for resonators with rectangular (sides 2a, 2b) spherical mirrors, $\frac{2kl}{\pi} = q + \frac{m+n+1}{2} - i\frac{\Lambda_a + \Lambda_b}{2\pi}$,

Also, new asymptotic formulas, which can be used elsewhere, for spheroidal wave functions are developed. Orig. art. has: 6 figures and 93 formulas.

SUB CODE: 09 / SUBM DATE: 22Apr64 / ORIG REF: 013 / OTH REF: 005

Card 2/2

L 23385-66 EWT(1) IJP(c) AT

ACC NR: AT5027157 SOURCE CODE: UR/3055/65/000/004/0130/0147

22

B+1

AUTHOR: Vaynshteyn, L. A. (Professor)

ORG: none

21,44,55

TITLE: Diffraction in open resonators with confocal mirrors. — Part 2

SOURCE: AN SSSR. Fizicheskaya laboratoriya. Elektronika bol'shikh moshchnostey, no. 4, 1965, 130-147

TOPIC TAGS: electron diffraction, resonator, open resonator, confocal mirror resonator

ABSTRACT: This is a continuation of the author's previous article (see pp. 106-129 of the same journal). Here, the diffraction loss is theoretically investigated of various modes in an open resonator formed by confocal circular spherical mirrors; the radius of curvature of the identical mirrors is equal to the distance between them and the mirrors are facing each other. An integral equation describing the mirrors is reduced to a second-order differential equation, and the latter is approximately solved by the method of standard equations. The complex natural frequencies can be

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L 23385-66

ACC NR: AT5027157

calculated from this formula: $2kl = \pi\left(q + \frac{\varkappa}{2}\right) - i\frac{\Lambda}{2}$, where $\varkappa$ is determined by another formula, q is a large integer; Λ is a quantity that represents the diffraction loss and is dependent on $\varkappa$ and $c = ka^2/2l$ (a is mirror radius, 2l is the distance between the mirrors). In determining c, the parameter $k = \pi(q + \varkappa/2)/2l$ or even $k = \pi\varkappa/2l$. If the confocal mirrors have slightly different radii of curvature, greater diffraction loss may result. Orig. art. has: 2 figures and 79 formulas.

SUB CODE: 09 / SUBM DATE: 22Apr64 / ORIG REF: 007 / OTH REF: 004

Card 2/2

L 23387-66 EWT(1)

ACC NR: AT5027158 SOURCE CODE: UR/3055/65/000/004/0148/0156

AUTHOR: Vaynshteyn, L. A. (Professor)

ORG: none

21

B+1

TITLE: Diffraction in open resonators with confocal mirrors. — Part 3

SOURCE: AN SSSR. Fizicheskaya laboratoriya. Elektronika bol'shikh moshchnostey, no. 4, 1965, 148-156

TOPIC TAGS: electron diffraction, resonator, open resonator, confocal mirror resonator

ABSTRACT: This is the final part of the author's 3-part article. It is devoted to the problem of norms of natural oscillations in a resonator. An integral over the mirror surface, which approximately determines the norm of an open resonator with planar mirrors, is generalized. The norm formula for a resonator with confocal mirrors is: $\int_0^1 f^2(t)\,dt = \frac{e^{2\pi v}+1}{\pi c} H$. This formula is modified to suit a number of particular cases. This formula can be used for calculating forced-oscillation conditions in a resonator. "The author wishes to thank V. A. Fok and P. L. Kapitsa for a valuable discussion of the work. Orig. art. has: 1 figure and 35 formulas.

21,44,55

SUB CODE: 09 / SUBM DATE: 22Apr64 / ORIG REF: 004

Card 1/1 fo

2